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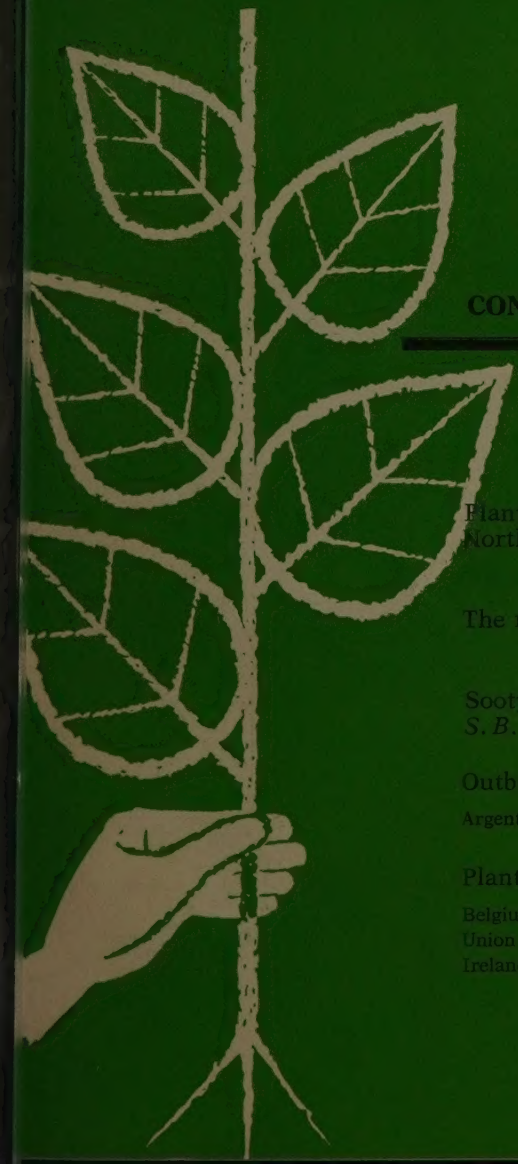

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PLANT EXPLORATION, COLLECTION AND INTRODUCTION

The requirements of an ever-increasing world population have created a pressing need for the introduction of new plant material which might offer possibilities of crop and grassland improvement. In view of this need, some countries have already taken steps to deal with this problem, while others have voiced an interest in trying to resolve it on a national or international basis.

This study, in reviewing briefly the botanical history of some representative economic plants, presents various timely views on a co-ordinated scientific approach to the exploration, collection and introduction of new plant material, and presents suggestions as to how international organizations might help provide such co-ordination, as well as the technical guidance necessary to ensure its success.

As stated in the foreword to the publication, "*this study indicates the need for a reassessment of the biological and genetical bases of plant introduction, perhaps also a revision or at least a consideration of Vavilov's centres of origin or centres of maximum variability, and certainly the development of more efficient and scientific methods of conducting exploration and collections ...*".

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FAO PLANT PROTECTION BULLETIN

A PUBLICATION OF THE WORLD REPORTING SERVICE ON PLANT DISEASES AND PESTS

Plant Diseases of Economic Importance in the Northern Region, United Arab Republic

by *D. Mulder,* formerly Expanded Technical Assistance Program, FAO, Damascus

While serving on an FAO assignment from August 1956 to July 1958, the writer had the opportunity of visiting most of the important agricultural areas in the northern region (Syria) of the United Arab Republic, to examine disease problems of major crops. Primary attention was given to diseases of horticultural crops. Although owing to the lack of laboratory and experimental facilities some of the diseases and disorders found could not be identified with certainty, the information thus accumulated appears to be worthy of being recorded.

In the region nutritional disorders and virus diseases are prevalent in fruit trees, and virus symptoms are very frequently observed in vegetables. Fungus diseases, on the other hand, appear to be in general prevented to a large extent by climatic conditions. Some fungi can cause serious damage even in dry areas, whereas others are restricted to areas with high rainfall and some are favored by heavy irrigation.

Nutritional disorders

As indicated by plant growth, the major nutritional elements are, as a rule, available in soil in such quantity that deficiency symptoms rarely develop. Nevertheless, owing to the low content of organic matter much nitrogen fertilizer is required. Many soils are low in phosphorous content but in general there is enough potash available. On the other hand, deficiencies of minor elements commonly occur.

Magnesium is deficient in many places. Citrus trees near Lattakia showed clear symptoms of magnesium deficiency, as did also apple trees near Zebedani. Some vegetables and garden plants near Damascus indicated chlorosis of the lower leaves as a result of magnesium deficiency.

Due to high pH and high lime content of the soil, severe symptoms of iron deficiency develop readily if other favorable factors are also present. In particular, poor aeration of the soil due to the soil structure and excessive irrigation applied too early in spring are the common factors conducive to iron deficiency.

Preliminary experiments and observations led to the conclusion that iron deficiency as it occurs in the fruit-growing area around Damascus and near Zebedani could be corrected to a great extent by planting a proper cover crop and applying irrigation only at the time when water is really needed. In particular, the observation that many trees showing severe chlorosis in spring have a much better leaf color in summer indicates that too much irrigation is one of the causes of chlorosis. Therefore, instead of applying organic iron compounds, more emphasis should be given to the adoption of appropriate cultural measures on soils which tend to give rise to severe iron deficiency.

Symptoms of zinc deficiency occur in most of the fruit-growing areas. They were found on citrus trees near Lattakia and on apple trees of Golden Delicious and other local varieties in many places. It is not yet clear what types of

soil are conducive to this deficiency. It is possible that phosphates used as artificial fertilizers may have an influence on the availability of zinc. However, no relation to overirrigation was found. The use of a cover crop like alfalfa would be the best solution to this problem, and a spray of 5 percent zinc sulfate before bud development could be used as a direct cure. After blossom-time a spray of 1.5 percent zinc sulfate plus 0.75 percent lime might be applied.

In two cases trees were suspected of having boron deficiency. Near Lattakia, olive trees were found to be suffering from a dieback on a poor eroded and very calcareous soil. In the same area south of Lattakia, near Djebel, citrus trees were also found to be suffering from dieback. Until analysis can be made, however, it is uncertain whether boron deficiency was the cause.

Virus diseases of fruit trees

Peach. Peach yellows was found for the first time in the orchard of the Agricultural School at Kharabo. Later the symptoms were observed in many orchards near Damascus and also in three orchards in the Zebedani valley. The symptoms varied somewhat, depending on the type of soil on which the trees were grown; those on highly calcareous soil showed more yellowing in the advanced stages of the disease. The first symptom occurred at the end of the growing season on the tops of new shoots. An affected top was split into several branches, a beginning of the witches' broom growth. The leaves on an affected top were abnormally small by comparison with normal leaves on lower parts of the same shoot. Trees with older infection showed a much reduced growth, with leaves in pale color. In the final stage of the disease, many branches were dead and only some tufts of yellow broom-like twigs remained on some of the larger branches. Eradication of diseased trees has been recommended.

Peach, plum and apricot trees were inoculated with peach yellows by budding but symptoms were shown only on peach trees.

Plum. On plum trees three types of virus symptoms were found. It is probable that they are due to infection of prune dwarf virus, leaf rolling virus and bark split virus. Experimental work on their identification was initiated, using budwood of two introduced indicator varieties (Italian prune and Cambridge gage). The work was not completed when the writer left Syria.

Apricot. No virus disease of economic importance seems to occur on apricot. One type of symptom appeared commonly, probably due to the infection of asteroid spot virus, which has been recorded on peach in Palestine. Identification of this disease by transmission to peach and plum was initiated but not completed. Seedling apricots (Kelabi) were found to be free of symptoms. Variety Baladi was almost completely infected. Three other varieties known as Hamwi, Wazari and Ajami were also infected but apparently to a lesser extent.

Cherry. Some wild symptoms of ringspot were found. The prevailing high temperature probably prevented the development of clear symptoms. Crinkle occurred on some cherry trees at the Agricultural School at Kharabo. Some sour cherries were suspected of having sour cherry yellows.

Apple. Symptoms of apple mosaic were not found in Syria. Some Italian Gravenstein trees in the orchard of the Agricultural School at Kharabo showed mild symptoms of flat limb on the trunk near the ground and much reduced growth. Gravenstein from the United States was healthy.

Fig. Fig mosiac is probably present in every fig orchard. Severe symptoms resulting in dwarfing of the trees were observed in different places. A start has been made with the selection of what might be resistant plants in a field of severely infected seedlings in the Sinn nursery near Lattakia.

Mulberry. Almost all mulberry trees showed vein banding on a certain group of leaves of similar age on affected branches. In many cases the symptom developed into chlorosis. On first view it appeared to be caused by aphid feeding but there were cases where it might be concluded that they were caused by a virus. In some instances the chlorosis was so severe that it looked as if iron deficiency might be the cause. Observations at a stage when the leaves are developing

will probably give more information as to the reason for this disorder.

CITRUS. No clear virus symptom was found on leaves of citrus tree. Some "scaly bark" was apparent in groves near Lattakia. This symptom appeared identical to psorosis B symptom, although it was not confirmed by transmission experiments.

Virus diseases of vegetables

SQUASHES. Cucumber mosaic occurred commonly in squashes, with the result that the growth of the crop was seriously reduced. Early and heavy infection was noted in the fields immediately around Damascus, but in a field at Kharabo the infection appeared much later and only to a limited extent. The difference is apparently due to the fact that the field at Kharabo was isolated and there were less weeds in the vicinity.

The following measures are recommended for the control of this disease:

a) use of virus-free seed;
b) elimination of first infected plants in the spring;
c) eradication of weeds which might act as hosts of the virus, in the vicinity of squash fields;
d) treatment of plants with insecticides to prevent the spread of the virus by insects;
e) use of resistant varieties.

TOMATO. The common virus diseases of tomato do not seem to occur to any extent in Syria. The fern leaf symptom due to the infection of cucumber mosaic virus was seen only once.

SWISS CHARD (*Beta vulgaris* var. *cicla*). In most fields of Swiss chard (Sellik) around Damascus, a heavy infection of a virus disease was noticed. The symptoms resemble those of beet mosaic, although there is the possibility that it may be cabbage black ringspot. The first symptoms consisted of yellow spots on leaves which might be the direct result of infection, probably transmitted by some insects. The disease then appeared on younger leaves, with the result that growth was stunted and chlorophyll formation was reduced. The leaves became twisted with a wavy margin, and some of them were so deformed with margins rolled downward that they appeared much narrower than normal.

Diseased plants were not evenly distributed in a field but were concentrated along the border. This suggests spread by an insect. Only in very severely affected fields did the diseased plants occur throughout the plot.

COS LETTUCES. Cos lettuces are the lettuce varieties most commonly grown around Damascus. It was noticed that some plants were dwarfed with vein clearing in leaves resembling the symptoms of the big vein disease of lettuce described from the United States, whereas other dwarf plants showed mosaic in leaves.

Parasitic diseases of fruit trees

Apple scab (*Venturia inaequalis*) and apple mildew (*Podosphaera leucotricha*) occur only in the Zebedani valley, where environmental conditions are favorable to the development of the diseases and control measures are still insufficient. Around Damascus both diseases were not found to be serious.

On peach, shot-hole (*Clasterosporium carpophilum*) was found abundantly, even in the dry zone near Damascus.

On pear trees on the mountains near Lattakia, pear rust (*Gymnosporangium sabinae*) occurs. From dead bark of pear trees near Damascus, a species of *Cytospora* was isolated.

Pistachio trees near Aleppo suffer greatly from an attack of *Phleospora pistaciae*. The perithecial stage of this fungus develops in spring on fallen leaves on the ground. No control measures have been tried so far.

Fig trees near Lattakia show early defoliation due to the fig rust (*Physopella fici*). A bark canker on the trunk was found on numerous trees in the north.

Quince trees in the Zebedani valley suffer badly from a *Sclerotinia* attack of flowers before and during blossom-time. From observations on the development of blighted flowers, the blighting due to the infection was found to take place at the beginning of April. Trials on the control

of this disease by spraying with fungicides failed to yield satisfactory results, probably because the ten-day interval between treatment which had been adopted was rather too long to protect the trees effectively. Besides, mummified fruit and dead twigs remaining on the tree served as a constant source of infection.

Judging from the appearance of quince trees in the experimental orchard, in addition to *Sclerotinia* disease, insects (mainly a leaf-roller) and frosts caused much damage. All these would require more adequate control or preventative measures. The use of late-blossoming varieties might be the best solution to the frost problem.

Apricot trees often suffer from an attack by the soil-borne fungus *Verticillium dahliae,* causing wilting of part of the tree. As tomato is also a host of this fungus, it is not advisable to grow tomato plants under apricot trees. In the neighborhood of Homs, *Sclerotinia cinerea* was found on apricot trees in the state nursery.

Young almond trees were found in 1957 to be infected by the peach rust *Puccinia pruni-spinosae.*

On grapes, both powdery mildew (*Uncinula necator*) and downy mildew (*Plasmopara viticola*) were present, but there was only occasional serious damage. Crown-gall, caused by *Agrobacterium tumefaciens,* on the other hand, was commonly observed on stems.

Parasitic diseases of vegetables

Potatoes suffer badly from three diseases, namely, *Rhizoctonia* disease, *Colletotrichum* root rot, and *Fusarium* tuber rot. *Rhizoctonia solani* was found in all the main potato-growing areas, causing serious losses due to the early death of affected plants. The fungus was repeatedly isolated from affected tubers and stolons. The destructiveness of this fungus lies not so much in its damage to the tubers as in the fact that it kills the stolons on which new tubers are to be formed. Sclerotia of the fungus are carried by new tubers and when such tubers are used for planting the disease spreads. Therefore, a program should be organized to enforce the disinfection of seed potatoes. In addition, it is important to introduce changes in cultural practices directed toward improvement of soil conditions. This can be achieved by:

a) growing potatoes on ridges instead of on flat land to obtain better soil aeration;
b) limiting irrigation to the strictly necessary amount;
c) planting seed as late as possible in order to promote rapid development of shoots, thus lessening risk of disease;
d) harvesting early to reduce infection;
e) limiting the use of fresh manure, as the parasite can live saprophytically on organic matter;
f) carrying out crop rotation in a four-to-six-year cycle.

Colletotrichum atramentarium, which attacks the stolons in particular, was found to be especially severe in the area of Serraya. *Fusarium* sp. causes a dry rot of tubers that may be of importance. In the area of Serraya the dry rot seemed to follow the infection of the stolons by *Colletotrichum.*

Tomatoes were noticed to be attacked to a limited extent by a root rot due to a species of *Fusarium.* Wilting due to *Verticillium* was also observed. Outside the oasis of Palmyra, a heavy infection of tomato plants by the root-knot nematode, *Meloidogyne* sp., was found in the autumn of 1956.

Parasitic diseases of other crops

WHEAT. Bunt or stinking smut caused by *Tilletia caries* is still the most important disease of wheat. Loose smut caused by *Ustilago tritici* is also present but to a much lesser extent. Although the losses due to these diseases were estimated to amount to as much as 20 percent of the harvest in average, no special measures have been taken to reduce the losses. It would be advisable to organize a campaign for the disinfection of seed grain against smuts.

Stem rust of wheat (*Puccinia graminis*) was found incidentally but was of little importance in the main wheat-growing areas.

POPLAR. Young poplar trees of the " Hamwi " type were found dying in two nurseries because of a bark rot near the ground level caused by *Cytospora chrysosperma*. This disease is probably favored by high air humidity near the ground as a result of excessive irrigation and growth of grasses and weeds around the trees. The application of a copper spray in spring and the improvement of the physical conditions of the soil might be helpful. Poplar rust (*Melampsora pinitorqua*) often causes severe loss of the foliage.

The Role of Aircraft in Locust Control in India

by *D. S. Gupta,* Directorate of Plant Protection, Quarantine and Storage, Ministry of Food and Agriculture, New Delhi

The destruction of locust swarms presents unique problems, particularly because of their mobility and large size. Sometimes swarms may travel hundreds of miles in a day and they may extend over hundreds of square miles. Locust hoppers also are perpetually on the move and they infest no less extensive areas than the flying locusts. As flying swarms are uncontrollable by the common ground methods of control, and as the duration of the hopper stage, which is the most vulnerable, is short, the time factor is very important in locust control and the quick application of insecticides over large areas is the only effective and promising method. Furthemore, since locusts are mostly found in regions which are not always easy to traverse on the ground, the use of aircraft for locust control appears to have many advantages.

Early developments in aerial dusting for locust control are summarized by Brown (1). Lately, increasing attention has been given to aircraft spraying, which was first tested in Russia in 1922 (3). With the advent of the newer highly concentrated and liquid insecticides, spraying has assumed even greater importance. Spraying operations against the desert locust (*Schistocerca gregaria*) with DNOC were first carried out in Kenya in 1945 (2) when both settled and flying swarms were attacked.

Use of aircraft in India

The first records of the use of aircraft in an anti-locust campaign in India date back to 1944, when Tiger Moth, Anson and Catalina aircraft were employed for reconnaissance purposes (4) but actual control operations were not undertaken with aircraft before 1951 (5). A summary of the use of aircraft in anti-locust campaigns in India is given below.

1944. In April 1943, the Locust Experts Committee recommended that if a suitable aircraft were available it should be used to determine whether hopper bands could be recognized from the air in areas where ground reconnaissance was difficult. This recommendation was not implemented until July 1944, when the then War Department agreed to loan some aircraft.

During 1944 Tiger Moth, Anson and Catalina aircraft were tested and reconnaissance flights for 696 hours, covering a distance of 58,367 miles, were undertaken. Although the results were not wholly satisfactory, the Tiger Moth was considered to be the most suitable type of aircraft. Hopper congregations could be located from a height of 25 to 200 feet and settled or flying swarms from heights up to 200 feet.

Owing to the high cost of such trials, no aircraft were used during the remaining two years of the 1940-46 locust cycle.

1950. When a new locust cycle started in 1949, India was alive to the potential value of aircraft in anti-locust campaigns, and when the cycle gained momentum in 1950, a Beechcraft Bonanza aircraft was chartered for reconnaissance. Unfortunately, after covering only 1,503 miles, this aircraft was destroyed in an accident.

1951. Early in 1951, the director of locust control in India recommended that the Central Anti-Locust Organization be strengthened, by providing some aircraft mainly for reconnaissance but also for experimental control operations. Meanwhile the United States of America had offered three light aircraft with pilots for a few months, under T.C.M. They also offered some aldrin insecticide and the services of an American expert in grasshopper control. The offer was accepted and three Piper Cub aircraft arrived at Bikaner on 13 July 1951. The Central Anti-

Locust Organization equipped an operational base at Nal aerodrome (28° 04'N. 73° 12'E.) and organized a ground party to locate and demarcate locust-infested areas.

The first reconnaissance flight was undertaken on 17 July and nine and a half hours reconnaissance flights were made. The first aerial spraying was carried out against a settled yellow and gray swarm on 2 August, and up to 27 August, one dozen yellow, resting or egg-laying swarms were sprayed with aldrin-kerosene oil mixture in the ratio of 1:20, resulting in the death of a great many locusts. Using 82.75 gallons of 60 percent aldrin and applying 5.33 ounces of aldrin per acre, a total of 2,080 acres were sprayed.

Aerial spraying against hoppers began on 26 August and continued until 24 September. During this period hoppers of I-V stages were sprayed with aldrin-kerosene oil mixture in the ratio of 1:32, in 12 localities. A total of 1,180 acres of hopper-infested area were sprayed by applying 29.82 gallons of 60 percent aldrin at a dosage of 3.39 ounces of aldrin per acre. Spraying against hoppers gave very good results. During these control operations the aircraft flew 49 hours 5 minutes.

The year 1951 marks the first year that aircraft were used for actual locust control operations in India and also the first time that aldrin insecticide was applied in the country against locusts. The trials revealed the prolonged residual effect of aldrin; a single normal application of the insecticide, any time after egg-laying, killed all the hoppers on emergence. This discovery proved very useful, as it added two weeks to the usual period for killing locust hoppers. This technique has subsequently been much used and large areas have been treated in this manner every year.

1952. In 1952 the United States of America again provided, under T.C.M., three light aircraft with pilots and one entomologist for locust control. The government of India made similar arrangements as in 1951 for the required ground supplies. Three main operational bases were selected and provided with supplies of aviation spirit, kerosene oil, etc. The three Piper Cubs reached Jodhpur on 23 July. At that time the locust situation in the Phalodi-Shergarh area (Jodhpur district) had become serious and the aircraft were, therefore, rushed to Phalodi, arriving there on 2 August, when a temporary airstrip had been completed. Immediately after arrival the aircraft took a reconnaissance flight and the pilots acquainted themselves with the area. Aerial operations started on 3 August and continued until 25 August. During this period spraying was carried out almost daily and large areas of Phalodi and Shergarh tehsils, heavily infested with eggs and various stages of hoppers, were cleared. When the situation became controllable by ground machinery the aircraft were moved to Uterlai (25° 48' N. 71° 30' E.), where they continued to operate from 28 August to 20 September. Here also operations were carried out almost daily and as many as 1,200 acres were sprayed in one day. From 21 September to 4 October, the aircraft remained at Jodhpur and attacked some pink settled swarms by spraying over 1,250 acres. From 5 to 25 October, when they finally left India, the aircraft remained at Bikaner ready to spray post-monsoon swarms invading India across the Pakistan border, but no swarm could be treated. During this period, the aircraft were used to train Indian pilots in low-level flying.

The locust infestation during 1952 was very heavy. In fact, it was the peak of the present locust cycle in India. There were, therefore, ample opportunities for testing the value of the aircraft. In all, 21,805 acres (330 acres against egg beds, 17,825 acres against hoppers and fledglings, and 3,650 acres against resting swarms) were sprayed, using 445 gallons of 60 percent aldrin. Some special features of the aerial spraying during 1952 were as follows:

1. In 1952, 60 percent aldrin was used as a mechanical dispersion in water instead of using a solution in kerosene oil as in 1951. This resulted in a saving of kerosene.
2. Comparatively low doses of aldrin, from 1.44 to 4.7 ounces, were found to be as effective as the 3.39 to 5.33 ounces used in 1951. This also resulted in a substantial saving of aldrin.
3. It was observed that the residual effect of aldrin lasted for about three weeks and that

rainfall any time after spraying had no adverse effect.

4. The preliminary observations, that aldrin when sprayed on egg beds will kill all the hoppers hatching therefrom, were confirmed.

1953. The United States of America again provided three Super Piper Cubs with pilots and an entomologist for locust control operations. The Central Anti-Locust Organization formed a ground party for locating and demarcating locust-infested areas and made other necessary arrangements. No dumps of large quantities of aviation spirit, kerosene oil, etc., were established, as experience had shown that such elaborate arrangements were unnecessary.

The aircraft first reported at the locust substation at Jodhpur on 22 July and were then moved to Bikaner. The locust infestation, though extensive, was not intensive and there were few opportunities for using the aircraft which sprayed on only three occasions, once on egg beds and twice on advanced stage hoppers. On 5 September the aircraft were moved to Phalodi (Jodhpur district) to undertake control operations against swarms entering India from Pakistan. Again, no good opportunities for spraying arose and the aircraft could be utilized on only three occasions. One of the aircraft was withdrawn early in October but the other two remained at Phalodi until 22 October. A total of 2,850 acres (300 acres against egg beds, 350 acres against hoppers and 2,200 acres against pink swarms) were sprayed, using 47.75 gallons nonemulsifiable and 7 gallons emulsifiable 60 percent aldrin concentrate, at a dose of 2.4 to 3.4 ounces of aldrin per acre. The results were almost 100 percent mortality in all cases, except once when a kill of about 40 percent adults was achieved.

As the aircraft remained idle for most of the time for want of spraying work, they were utilized for reconnaissance, for which purpose they flew 21.5 hours. The experience, however, revealed that these aircraft served no useful purpose in locating locust infestations, except sometimes for designating settling swarms. Now that the network of the Central Anti-Locust Organization is so extended and no areas remain unexplored, there is little use for reconnaissance aircraft.

1954. In 1954 the government of India did not avail itself of the assistance offered by the United States in provision of aircraft and pilots, as the Central Anti-Locust Organization proposed to use their own aircraft for locust control. Some small aircraft were available in the country and the United States had supplied three Sorenson Loadmaster spraying units, under T.C.M., which were fitted on three chartered Piper Cubs. In addition to the pilots, an engineer and six mechanics were made available.

The Central Anti-Locust Organization provided technical staff for demarcating infested areas and for handling materials.

On 6 August the aircraft went into action for the first time, and up to 21 August operated from Jodhpur and from supbases at Bhawad (26°33'N. 73°07'E.), Kirmari (26°35'N. 73°02'E.) and Nimli (26°0'N. 73°05'E.). On 22 August the unit moved to Sojat (Pali district) and operated from bases at Sojat (25°55'N. 73°43'E.) and Marwar Junction (25°42'N. 73°36'E.) until 13 September, when the aircraft returned to Jodhpur. On 30 September the chartered aircraft returned to Lucknow.

A total of 5,992 acres of locust-infested area were sprayed, using 338.5 gallons of 40 percent and 4.5 gallons of 60 percent aldrin emulsifiable concentrates. The total flying time was 108 hours 5 minutes, of which 70 hours and 5 minutes were spent in actual spraying, including the time taken in flying from the operational base to the spraying site. The remaining 38 hours were used to move bases.

In 1954, in the scheduled desert area of India, the infestation was not heavy and therefore the aircraft could not be used daily. In Pali district, which is outside the scheduled desert area, however, the situation got out of control, and it was here that the aircraft were rightly employed. If large areas had not been cleared, several swarms would have been formed.

When the aircraft moved to Lucknow on 30 September the spraying equipment remained with the aircraft, so that they would be in readi-

ness for any possible emergency. Although no emergency arose in the scheduled desert area, three big pink swarms entered Madhya Pradesh through Hoshingabad, Chhindwara and Raipur districts, between 18 October and the first week of November and spread over Nagpur, Wardha and Yootmal districts of Bombay, and Drug and Bilaspur districts of Madhya Pradesh, where they started to cause serious damage. The state anti-locust authorities tried to exterminate the locusts and asked the Central Anti-Locust Organization for one aircraft for spraying settled swarms. This aircraft operated on 14 occasions between 3 and 18 November and covered an area of 950 acres, flying a total of 33 hours 5 minutes.

It is significant that 1954 was the first year of locust control by aircraft in India, with Indian pilots carrying out all the operations. It was also the first year when the aircraft were utilized for locust control outside the scheduled desert area in this country.

1955. Since 1955 locust activity has been so low that it was unnecessary to form any aerial units.

Summary

The use of aircraft in anti-locust campaigns in India started in 1944 when three types of aircraft were tried for reconnaissance purposes. Actual control operations by aircraft were not undertaken until 1951. For three years, from 1951 to 1953, the control operations were carried out by U. S. pilots with U. S. aircraft obtained under the T.C.M., but in 1954 Indian pilots for the first time undertook the work with their own aircraft.

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Sooty Mold of Rice in Pakistan[1]

by *S. B. Ali, Abdul Ghafoor and Khursheed Akbar*, Department of Plant Protection, Karachi

Sooty molds, although they occur commonly on rice and other gramineous plants in temperate countries, are not generally considered of economic importance. The unusually heavy infestation in Pakistan as reported in the present note, however, caused much damage to rice growth and consequently yield reduction. They seem to deserve attention and further study.

During the summers of 1952 and 1953, it was observed at Buhara, 60 miles east of Karachi in the Thatta district, that one of the commonly grown rice varieties, Khasro, was seriously infested by aphids and subsequently by sooty molds which damaged about 50 percent of the plants. The molds began to appear on the honeydew of aphids in early September. High humidity due to standing water in the field provided conditions favorable to mold growth.

The infested plants were covered by black mycelial growth on stems, leaves, leaf sheaths, panicles and glumes (Figures 1, 2). The affected leaves were curled and had a withered appearance. Only the upper surface of leaves was infested, and when the mold growth was removed by thorough washing, the underlying leaves showed dirty gray color instead of green. The panicles ripened prematurely with most of the spikelets empty. When heavily infested, late tillers failed to produce panicles. The affected field looked as if it had been burned. The part of the stem submerged in water, however, was not infested.

On heavily infested plants, as much as 78.5 percent of the spikelets were either completely empty or contained only poorly-developed grains. Table 1 shows that even when infestation was medium or slight, a large number of spikelets were empty or half-filled.

The injurious effects to host plants mentioned above seem to be rather unusual for sooty molds. Some of these effects could of course be due to the infestation of aphids rather than sooty molds.

When spikelets are infested with sooty molds, grains showed discoloration of varying degrees and in some cases blackening at one end. In a sample of 500 grains from moldy spikelets, 72.8

[1] Contribution No. 2/58, Department of Plant Protection, Karachi, Pakistan.

TABLE 1. Relationship between the intensity of infestation by sooty molds on rice and the percentage of empty or half-filled spikelets

Intensity of infestation	Percentage of spikelets		
	empty	half-filled	normal
Heavy	64.1	14.4	21.5
Medium	40.2	14.6	45.2
Slight or none	13.9	8.9	77.2

Figure 1. Rice variety Khasro, showing infestation of sooty molds on stems, leaves and leaf sheaths.

percent was found discolored, whereas in a similar sample from clean spikelets, only 20.8 percent of grains was discolored. In germination tests the discolored and clean grains showed slight differences. The discolored grains germinated quicker, with a slightly higher rate than

Figure 2. Rice grains of variety Khasro, heavily infested by sooty molds; clean grains at right.

clean grains, but the seedlings were soon overrun by fungi and subsequently died.

With or without previous washing infested pieces of stems, leaves, leaf sheaths and grains, with or without husks, were treated with mercuric chloride. When cultured on agar medium, they yielded the following fungi, in the order of frequency:

Helminthosporium	*Fusarium*
Curvularia	*Aspergillus*
Nigrospora	*Mucor*
Mycelia sterilia	Unidentified species
Alternaria	

Samples of grains without husks from discolored or clean spikelets were also thoroughly washed, surface-sterilized and plated. It was found that 75 percent of the discolored grains and 30 percent of clean grains yield fungi. From the discolored grains, the fungi obtained frequently in order of prevalence were *Helminthosporium, Alternaria, Curvularia,* and an unidentified species, but less frequently *Nigrospora, Cladosporium, Aspergillus, Mucor, Penicillium* and *Fusarium* were also isolated. From the clean grains, however, only the first four fungi were obtained.

Outbreaks and New Records

ARGENTINA

by *Amalia F. Moreno,* Instituto Nacional de Tecnología Agropecuaria, Buenos Aires

Nematodes found in cotton fields

Nematodes attacking cotton have been reported for many years from the northern provinces of Argentina. In 1939 *Meloidogyne* sp., then known as *Heterodera marioni* (Cornú) Goodey, was found in the Chaco area. In 1945 the Laboratory of Agricultural Zoology in Buenos Aires identified the same nematode on soil-root samples received from Resistencia in the Chaco province. Later heavy infection of *Ditylenchus dipsaci* Kirjanova was found on root collar and stem of cotton plants from Resistencia and from Colonia Macías in the province of Santa Fé. In 1951 and 1953 *Meloidogyne* sp. was determined on plants showing wilt symptoms and also on apparently healthy plants in Presidencia Roque Sáenz Peña, Chaco province. In addition, *Aphelenchus avenae* and *Aphelenchus* sp. were identified on plants from various places in the cotton-growing area.

Studies in the United States on cotton wilt have revealed that nematodes pave the way for the entry of *Fusarium* species into roots. This relationship was not given attention in Argentina until recently. During the past years losses caused by cotton wilt became serious, and a systematic investigation of the disease was therefore initiated in July 1957. In this investigation, root knot and other parasitic nematodes, free-living (saprophytic and predatory) nematodes and nematode-trapping fungi were found on wilted plants from the provinces of Salta and Catamarca and from Presidencia Roque Sáenz Peña, La Matanza, Las Breñas and Resistencia in the Chaco province. Although the exact role of the nematodes in the development of the wilt disease has not been determined, a relationship similar to that found in the United States probably exists.

In samples from wilt-infested soil, the root-knot nematodes, *Meloidogyne* spp., were found most frequently and the following parasitic nematodes were identified:

Meloidogyne sp.
Meloidogyne incognita Chitwood
Meloidogyne incognita var. *acrita* Raski & Allen
Pratylenchus pratensis Cobb
Aphelenchoides solani Steiner
Aphelenchoides sp.
Ditylenchus sp.
Rotylenchus sp.

During February, March and April of 1958 further examinations were made from plants collected in varietal tests established in wilt-infected soil in Presidencia Roque Sáenz Pena and La Matanza. The following nematodes were identified: *Meloidogyne incognita* var. *acrita* was the only root-knot nematode attacking North American cotton and occupied about 90 percent of the total nematode population. *Pratylenchus pratensis, Aphelenchoides solani, Meloidogyne incognita* and *Meloidogyne* sp. were also found rather frequently.

The following cotton varieties appeared to be tolerant to the wilt-nematode complex:

Sáenz Peña M 288 (SP85 × C100 W5)
Plains (1954)
Stone Wilt
Auburn 56
Cocker 100 Wilt Br. 1956.

NORTHERN AFRICA

International Desert Locust Information Service, London

Desert locust plague

The breeding of the desert locust (*Schistocerca gregaria* Forsk.) has been heavy in many parts of the African summer-breeding belt, particularly in the Sudan Republic, northern Ethiopia, Niger Colony and Mauritania. Much of the breeding has occurred in areas difficult of access, where no control could be undertaken.

Numerous new swarms were forming in September 1958 and many more are expected to appear. The northward spread of these swarms is in progress. Some have appeared in the Central Sahara, a dense swarm, 1,500 square kilometers in extent, has reached southeastern Morocco, and a large swarm invaded Ghat oasis in the Fezzan.

All countries of northwestern Africa, Libya, Egypt and Arabia are in imminent danger of heavy swarm invasions, which may continue in the winter and are expected to lead to serious breeding next spring.

SOUTHERN RHODESIA

by *J. A. Whellan,* Entomological Branch, Federal Ministry of Agriculture, Salisbury

Insect incidence in first half of 1958

Bugh of the genus *Helopeltis* were reported with increasing frequency damaging mangoes, guavas, avocadoes, granadillas and occasionally other fruits. The species concerned is under investigation. *Eurystylus capensis* appears to be the principal pest of castor beans, a crop which has aroused considerable interest recently. It causes severe damage to foliage and to the candles resulting in premature capsule fall.

Aphids, *Rhopalosiphum maidis,* were present in such numbers on some crops of winter barley in the Fort Victoria (southern S. Rhodesia) area that they caused yellowing and wilting of the leaves over substantial areas.

TRINIDAD (British West Indies)

by *E. O. Pearson,* Commonwealth Institute of Entomology, London

Elasmopalpus lignosellus: *A new record*

Larvae of *Elasmopalpus lignosellus* (Zell.) (Lep., Pyralidae), which, according to Fennah, [1] occurs in Central and South America, Greater and Lesser Antilles and also in the southern states of the United States, where it is known as the lesser cornstalk borer, are recorded as attacking sugar cane in Trinidad for the first time. Immense damage was caused to young ratoons on one estate in particular. It is thought that the attack on cane may have been present but unnoticed for several years.

According to Fennah, the larvae usually infest the stems of leguminous crops in the West Indies but graminaceous stems are also attacked, and Wolcott [2] states that it was first noted attacking sugar cane in Puerto Rico in 1924, since when it has been found there repeatedly in fields of young ratoons in which the trash has been burned.

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[1] Fennah, R. G. 1947. Pests of food-crops in the Lesser Antilles. St. Georges, Grenada, etc., Deps. Agr. Windward and Leeward, Islands (*see* pp. 125-126).

[2] Wolcott, G. N. 1950-51. The insects of Puerto Rico. *Jour. Agr. Univ. Puerto Rico.* 32:1-975 (*see* p. 703).

Plant Quarantine Announcements

BELGIUM

Ministerial Decree of 13 January 1958, published in the *Moniteur Belge* No. 46 of 15 February 1958, designates customs offices, through which living woody plants or parts thereof (including those requiring fumigation) and fresh fruit of woody plants may be imported. This new decree, which revokes Ministerial Decree of 13 March 1952 is related to Royal Decree of 12 Mach 1952 (see *FAO Plant Prot. Bull.* 1 : 30, 1952, 3 :157, 1955) concerning measures for preventing the introduction and spread of San José scale (*Aspidiotus perniciosus*).

BRITISH HONDURAS

The Plants, Fruits and Vegetables (Importation) (Amendment) Regulation of 1 August 1958, published as Statutory Instrument No. 34 of 1958, amends the Plants, Fruits and Vegetables Importation Regulations of 8 January 1947. This amendment provides for the prohibition of importation of any citrus plant, any coconut plant, and any plant or seed of the mahogany family (Meliaceae) from the Island of Trinidad, British West Indies. Previously the importation of citrus and coconut plants from any source was prohibited, and plants and seeds of the mahogany family were not specifically restricted.

DENMARK

Supplementary Order of 27 February 1958, issued by the Ministry of Agriculture and published in the *Lovtidende* A. No. 5 on 1 March 1958, modifies the conditions laid down in Order of 27 April 1953 (see *FAO Plant Prot. Bull.* 1 :158-159, 1953) with regard to the importation of onions and bulbs, etc.

By the new order, the stem and bulb nematode (*Ditylenchus dipsaci*) of onions (*Allium*) is added to the list of prohibited diseases and pests given in the Order of 27 April 1953. Onion (*Allium cepa*) weighing up to 20 grams, shallot (*A. ascalonicum*) and flower bulbs and flower tubers destined for importation, must originate from plants which were officially inspected in the field during the preceding growing season and were found to be free from the stem and bulb nematode. Furthermore, each consignment must be inspected immediately before dispatch and found to be free from dangerous plant diseases and pests.

The new order does not change the requirements hitherto in force to the effect that the plants by field inspection must be found to be substantially healthy and that the growing field must be free from Colorado beetle and potato wart disease and, on examination of soil samples, free from potato root nematode.

DOMINICAN REPUBLIC

Law No. 4990 of 28 August 1958, published in *El Caribe* of 31 August 1958, regulates the importation of plant material and revokes and supersedes Law No. 939 of 23 May 1928, together with amendments and any other disposition that might be in contradiction to the provisions of the new laws.

General regulations

Importation of plants, fruits, seeds, bulbs, rhizomes, flowers and any part of plant, living or dead, is prohibited, except when permission has been obtained from the Ministry of Agriculture. Such materials may be introduced only through the ports specified by the ministry.

Any traveller from abroad carrying plant material should declare it to the transport company and the material must be accompanied by a fumigation or phytosanitary certificate.

Ships and aircraft on the way to the Dominican Republic must cease distribution to passengers of fruit or vegetables five miles before arriving at the port of destination. Plant refuse must be kept in hermetically sealed containers and delivered to the plant protection inspector at the port of destination.

Any authorized shipment of plant material must be free from pests and disease symptoms, soil, sawdust or any foreign substance, except previously disinfected moss used for packing.

Any imported plant material must be accompanied by a phytosanitary certificate issued by an officer of the department of agriculture of the country of origin, stating that the plant material has been examined and found to be free from pests or diseases. The material will not be released by the customs until it has been examined by a plant protection inspector and a certificate has been issued by him.

Importation prohibited

1. The importation of plants that contain narcotic drugs or might be used to produce such drugs, is prohibited.
2. The importation of living or dead coniferous trees or parts thereof (except seed) is prohibited.

Importation restricted

1. Plant material of sugar cane, maize, rice, coffee, cacao, tobacco and plantain may be imported only if:
   a) originated from an experiment station or establishment, officially recognized in the country of origin;
   b) accompanied by a certificate issued by the department of agriculture of the country of origin, stating that the crop was grown under supervision of the department and was free from pests and diseases during the growing season.

   The importer of such plant material is obliged to inform the ministry of agriculture where the plants will be grown and to report at regular intervales on the health conditions and development of the crop. The ministry of agriculture will inspect the crop and order its destruction if deemed necessary.
2. Seeds of coniferous trees may be imported if found to be free from pests and diseases or disinfected at the port of entry.

UNION OF SOUTH AFRICA

Two proclamations of 28 March 1958 published in the *Government Gazette* No. 6045 on 11 April 1958 refer to the importation of rice.

Proclamation No. 88 declares seed of the rice plant (*Oryza sativa*), including all unhusked rice and seed rice, to be a plant for the purpose of the Agricultural Pest Act 1957 (see *FAO Plant Prot. Bull.* 6:45-46, 1957).

Proclamation No. 89 prohibits the importation of seed of the rice plant or seed rice from Cuba, Panama, Venezuela or any other country where the disease of the rice plant known as *hoja blanca* (white leaf) occurs.

UNITED KINGDOM (Jersey)

The Importation of Plants, Seeds and Potatoes (Amendment No. 2) (Jersey) Order, 1958, amends the Importation of Plant, Seeds and Potatoes (Jersey) Order, 1956, with regard to the importation of raw apples, apricots, greengages, nectarines, peaches, pears and plums grown in any European country, except Belgium, Denmark, Finland, Luxembourg, Norway, Sweden and the Netherlands. The requirements are the same as those promulgated by Northern Ireland (*see* next abstract).

UNITED KINGDOM (Northern Ireland)

The Importation of Plants (Amendment) (Northern Ireland) Order, 1958, amends the Importation of Plants (Northern Ireland) Order, 1955 (see *FAO Plant Prot. Bull.* 3:143, 1955), with regard to the importation of fresh fruit.

By the new amendment, the landing of raw apples, apricots, greengages, nectarines, peaches, pears and plums grown in any European country, except Belgium, Denmark, Finland, Luxembourg, Norway, Sweden and the Netherlands, is prohibited, unless each consignment has been examined by an officer of the phytopathological service of the country in which the fruit was grown and found to be free from San José scale (*Quadraspidiotus perniciosus*) and substantially free from all species of Lepidoptera, including Oriental fruit moth (*Laspeyresia molesta*). A health certificate to this effect must accompany each consignment.

The landing of raw apples grown in the U.S.A. is prohibited during the period from 7 July to 15 November in any year, unless they are of the grades of "U.S. Fancy," "U.S. No. 1," "Extra Fancy" and "Fancy."

Roma, 1958 — Tipografia del Senato del Dott. G. Bardi

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